Short Course on the Fundamentals of Boundary Layer Wind and Temperature Profiling Using Radar and Acoustic Techniques

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QUALITY ASSURANCE

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Session Overview

Goal: Understand the role of quality programs in the collection of upper-air meteorological data

- ⇨ References and guidance
- ⇨ Definitions
- ⇨ Quality assurance procedures
- ⇨ Quality control procedures
- ⇨ Monitoring and quality assurance plans
- ⇨ The role of audits
- ⇨ The audit process

References and Guidance

Document	Year
Quality Assurance Handbook for Air Pollution Measurement Systems Volume IV: Meteorological Measurements	March, 1995
EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5)	February, 1998
Meteorological Monitoring Guidance for Regulatory Modeling Applications	February, 2000

Quality Definitions

- ⇨Quality Assurance
- ⇨Quality Control
- ⇨Bias
- ⇨Precision
- ⇨Traceability
- ⇨Audit
- ⇨Quality Assurance Project Plan

Quality Definitions

Quality Assurance

An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

Quality Definitions

Quality Control

The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality.

Quality Definitions

Bias

The systematic or persistent distortion of a measurement process which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).

Quality Definitions

Precision

A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions, expressed generally in terms of the standard deviation.

Quality Definitions

Traceability

The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for quality for the project.

Quality Definitions

Audit

A systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

Quality Definitions

Quality Assurance Project Plan

A formal document describing in comprehensive detail the necessary QA, QC, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria.

The Monitoring and Quality Assurance Plan(s)

What is a Monitoring and Quality Assurance Plan?

The road map for the collection, processing, validation and reporting of the data

Elements of the Monitoring and Quality Assurance Plans

- Introduction and overview
- Program organization
- QA objectives
- Measurement procedures
- Quality assurance program
- Data review, validation and reporting

Elements of the Monitoring and Quality Assurance Plans

- ⇨ Introduction and overview
- ⇨ Program organization
- ⇨ QA objectives
- ⇨ Measurement procedures
- ⇨ Quality assurance program
- ⇨ Data review, validation and reporting
- ⇨ Problem description
- ⇨ Project description
- ⇨ Monitoring site description
- ⇨ Scope of the monitoring effort
- ⇨ Monitoring schedule

Elements of the Monitoring and Quality Assurance Plans

- ⇨ Introduction and overview
- ⇨ Program organization
- ⇨ QA objectives
- ⇨ Measurement procedures
- ⇨ Quality assurance program
- ⇨ Data review, validation and reporting
- ⇨ Project organization chart
- ⇨ Delineation of project authority and responsibility
- ⇨ Problem reporting chain

Elements of the Monitoring and Quality Assurance Plans

- Introduction and overview
- Program organization
- QA objectives
- Measurement procedures
- Quality assurance program
- Data review, validation and reporting

- Understand the intended use of the data
  - Data accuracy
  - Data ranges
  - Data completeness
  - Data units and time conventions

Elements of the Monitoring and Quality Assurance Plans

- ⇨ Introduction and overview
- ⇨ Program organization
- ⇨ QA objectives
- ⇨ Measurement procedures
- ⇨ Quality assurance program
- ⇨ Data review, validation and reporting
- ⇨ Each variable defined
- ⇨ Data logging
- ⇨ Averaging intervals and algorithms
- ⇨ Exposure
- ⇨ Training
- ⇨ Standard Operating Procedures

Elements of the Monitoring and Quality Assurance Plans

- ⇨ Introduction and overview
- ⇨ Program organization
- ⇨ QA objectives
- ⇨ Measurement procedures
- ⇨ Quality assurance program
- ⇨ Data review, validation and reporting
- ⇨ Training
- ⇨ Calibration procedures and frequency
- ⇨ Preventive maintenance
- ⇨ Quality control checks and frequency
- ⇨ System and performance audits
- ⇨ Corrective action procedures

Elements of the Monitoring and Quality Assurance Plans

- ⇨ Introduction and overview
- ⇨ Program organization
- ⇨ QA objectives
- ⇨ Measurement procedures
- ⇨ Quality assurance program
- ⇨ Data review, validation and reporting
- ⇨ Routine polling and review
- ⇨ Automatic screening of data
- ⇨ Data quality levels
  - level 0, 1, 2
- ⇨ Reconciliation with DQOs
- ⇨ Reporting

Audits

- ⇨ Audit definition
- ⇨ System audit
- ⇨ Performance audit
- ⇨ Role of the auditor
- ⇨ Role of the auditee
- ⇨ Audit equipment
- ⇨ Audit frequency

Audits

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- ⇨ System audit
- ⇨ Performance audit
- ⇨ Role of the auditor
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- ⇨ Audit equipment
- ⇨ Audit frequency

A systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives

Audits

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- ⇨ System audit
- ⇨ Performance audit
- ⇨ Role of the auditor
- ⇨ Role of the auditee
- ⇨ Audit equipment
- ⇨ Audit frequency

A systematic on-site qualitative review of facilities, equipment, training, procedures, record-keeping, validation, and reporting aspects of a total (quality assurance) system, to arrive at a measure of the capability and ability of the system.

Audits

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- ⇨ System audit
- ⇨ Performance audit
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- ⇨ Audit equipment
- ⇨ Audit frequency

An independent assessment of the performance of the instruments to determine if they are producing valid data.

- Direct challenge using known inputs
- Collocated Transfer Standard

Audits

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- ⇨ System audit
- ⇨ Performance audit
- ⇨ Role of the auditor
- ⇨ Role of the auditee
- ⇨ Audit equipment
- ⇨ Audit frequency

The auditor must be independent of the monitoring operations

- guest at the site and of the monitoring program
- independent evaluation of the site operations
- mutual training exercise

Audits

- ⇨ Audit definition
- ⇨ System audit
- ⇨ Performance audit
- ⇨ Role of the auditor
- ⇨ Role of the auditee
- ⇨ Audit equipment
- ⇨ Audit frequency

The auditee should be the normal operator of the site

- Responsible for day to day operations
- Removal and reinstallation of site instrumentation
- Answer questions about the site operations

Audits

- ⇨ Audit definition
- ⇨ System audit
- ⇨ Performance audit
- ⇨ Role of the auditor
- ⇨ Role of the auditee
- ⇨ Audit equipment
- ⇨ Audit frequency

- ⇨ Independent of the site instrumentation
- ⇨ Traceable to known standards
- ⇨ Of suitable accuracy to appropriately assess the site instrumentation performance

Audits

- ⇨ Audit definition
- ⇨ System audit
- ⇨ Performance audit
- ⇨ Role of the auditor
- ⇨ Role of the auditee
- ⇨ Audit equipment
- ⇨ Audit frequency

Typical EPA recommendations

- ⇨ System: Annual
- ⇨ Performance: Annual

The Audit Process

- ⇨ System Audits
- ⇨ Performance Audits

- ⇨ System audit checklist
  - – Observables, equipment, exposure, operations
  - – Procedures, training, data chain of custody
  - – Preventive maintenance
- ⇨ Site vista evaluation
  - – Orientation, level
  - – Picture documentation
- ⇨ Operating environment
  - – Background noise
  - – Potential sources of interference

Sample Picture Documentation

000°

045°

090°

135°

180°

225°

270°

315°

View of Site →

Antenna Orientation

COMPASS
Version 1.2

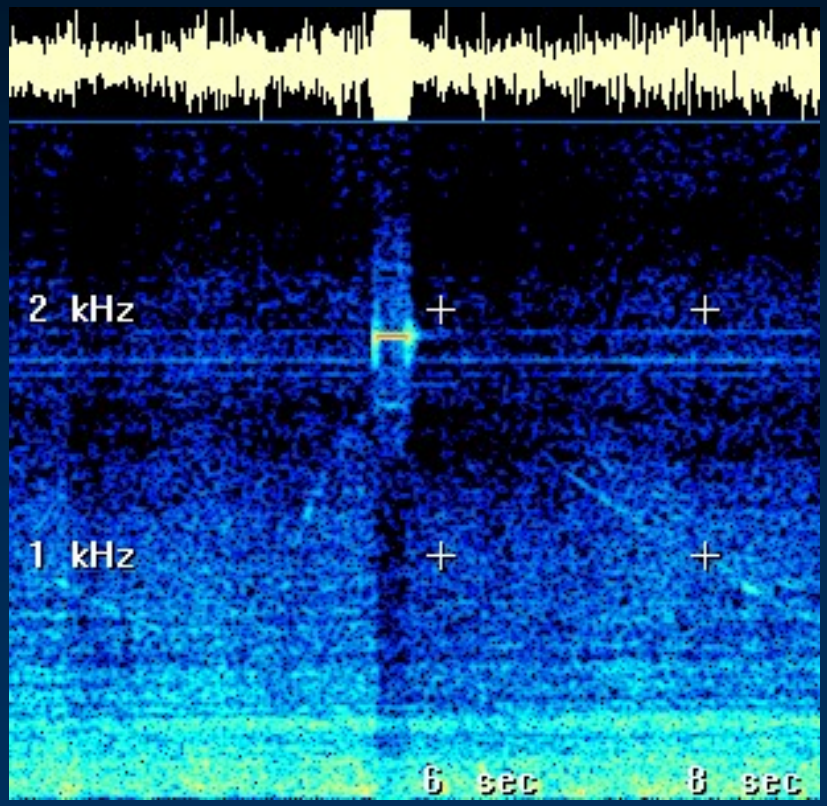
Site: Valencia Prepared by: Bob Baxter 04-21-2002
Longitude: 118 33.06 West Time Zone: PDT
Latitude : 34 24.54 North Time of Solar Noon: 12:52:53

Time	Elev	Azim	Time	Elev	Azim	Time	Elev	Azim
13:26	66.37	200.57	13:41	65.07	208.93	13:56	63.40	216.44
13:27	66.30	201.15	13:42	64.97	209.45	13:57	63.28	216.91
13:28	66.22	201.73	13:43	64.87	209.98	13:58	63.15	217.38
13:29	66.14	202.31	13:44	64.77	210.50	13:59	63.03	217.85
13:30	66.06	202.88	13:45	64.66	211.02	14:00	62.90	218.30
13:31	65.98	203.45	13:46	64.55	211.53	14:01	62.77	218.76
13:32	65.90	204.01	13:47	64.44	212.04	14:02	62.64	219.21
13:33	65.82	204.57	13:48	64.33	212.54	14:03	62.51	219.66
13:34	65.73	205.13	13:49	64.22	213.04	14:04	62.38	220.10
13:35	65.64	205.68	13:50	64.11	213.54	14:05	62.24	220.55
13:36	65.55	206.23	13:51	63.99	214.03	14:06	62.11	220.98
13:37	65.46	206.78	13:52	63.88	214.52	14:07	61.97	221.42
13:38	65.36	207.32	13:53	63.76	215.01	14:08	61.84	221.85
13:39	65.27	207.86	13:54	63.64	215.49	14:09	61.70	222.27
13:40	65.17	208.39	13:55	63.52	215.97	14:10	61.56	222.70

Press (Q)uit (R)un again Use keyboard Print screen function for hardcopy

Antenna Level

Background Noise Assessment



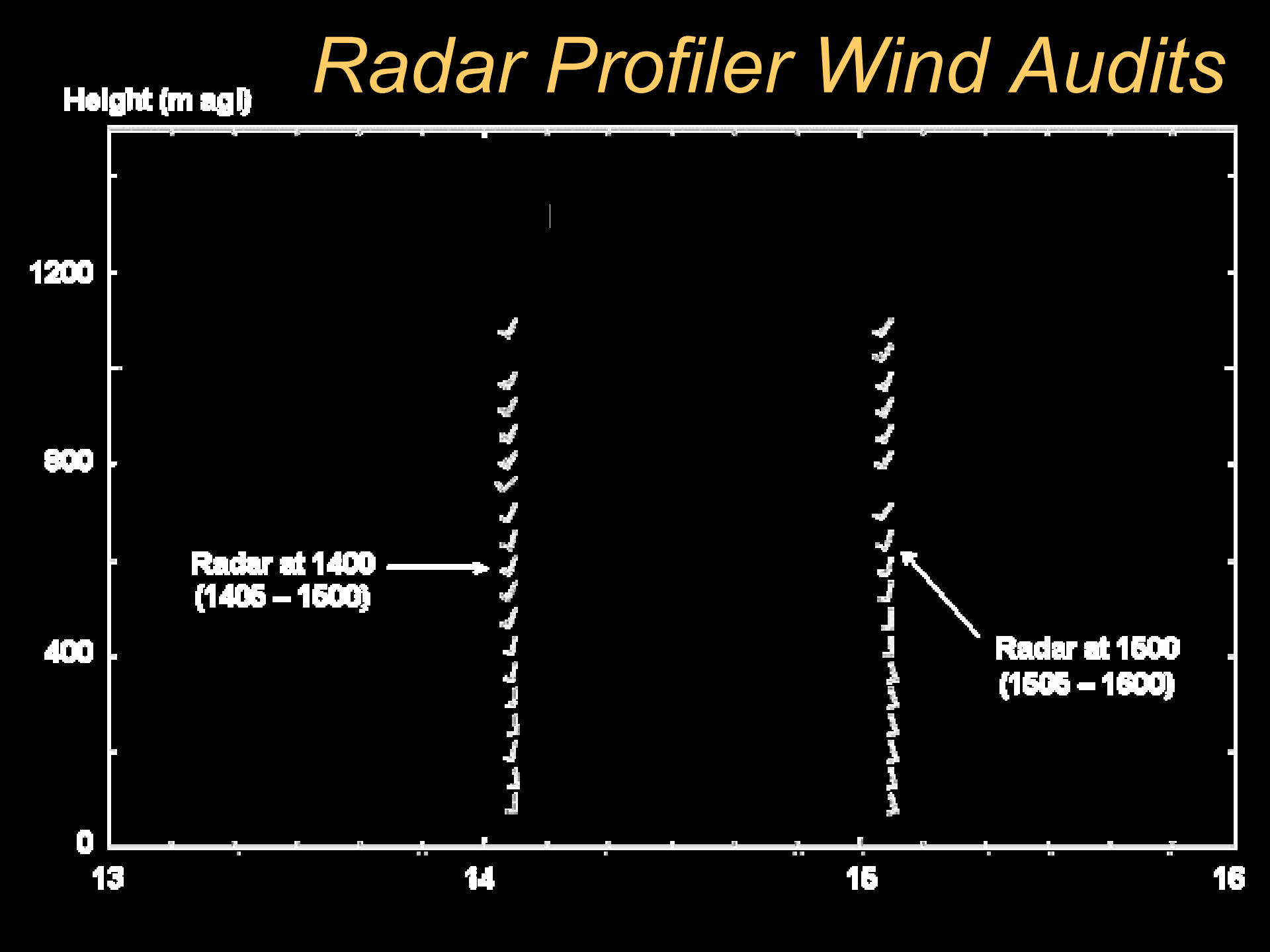
The Audit Process

- ⇨ System Audits
- ⇨ Performance Audits

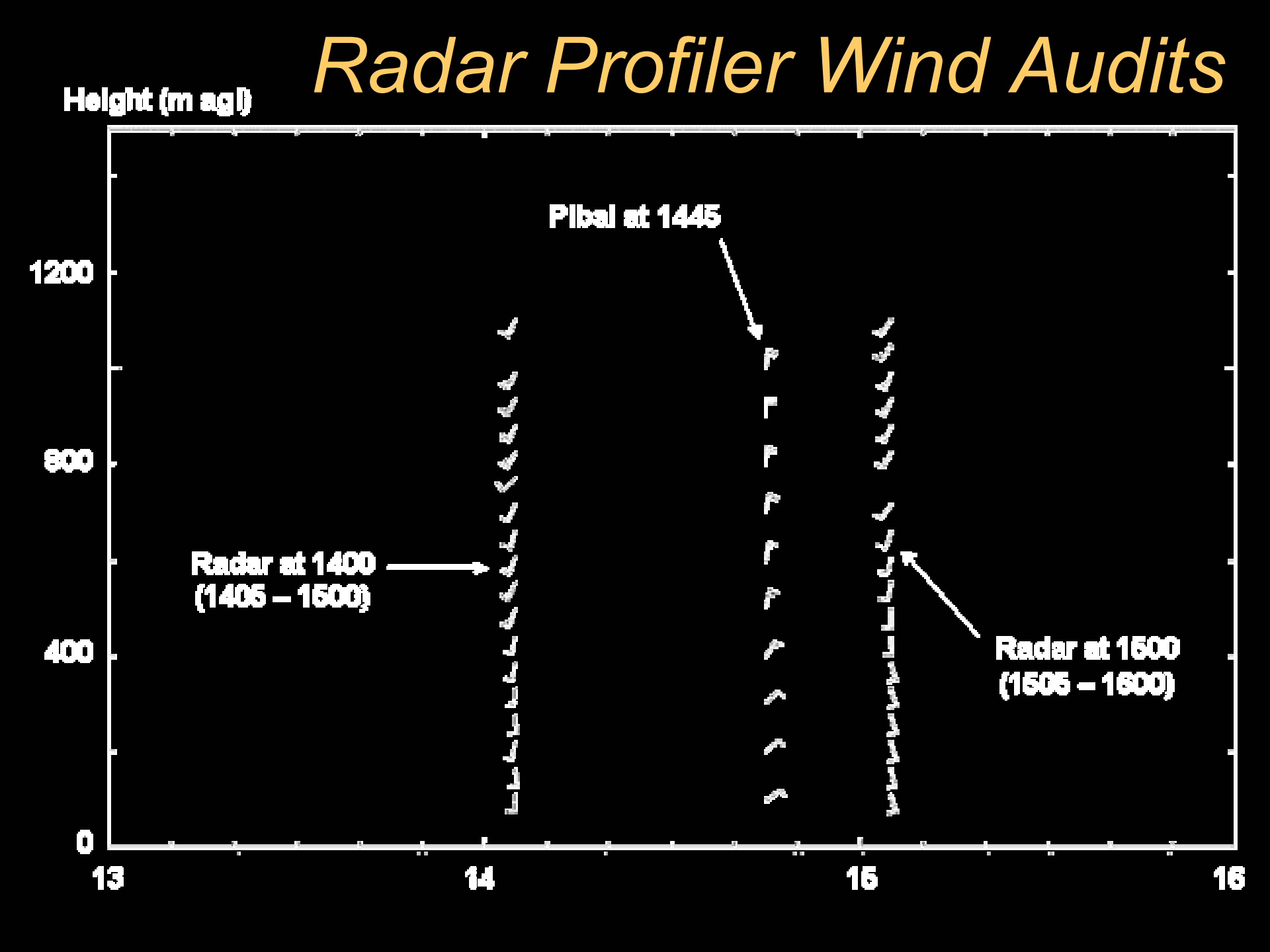
- ⇨ Radar profiler (winds)
  - – Portable sodar
  - – Rawinsonde
  - – Pibals
- ⇨ RASS (Tv)
  - – Rawinsonde
  - – Tethered sondes
- ⇨ Sodar (winds)
  - – Simulated winds using APT
  - – Pibals, kites, etc., another sodar

Radar Profiler Wind Audits

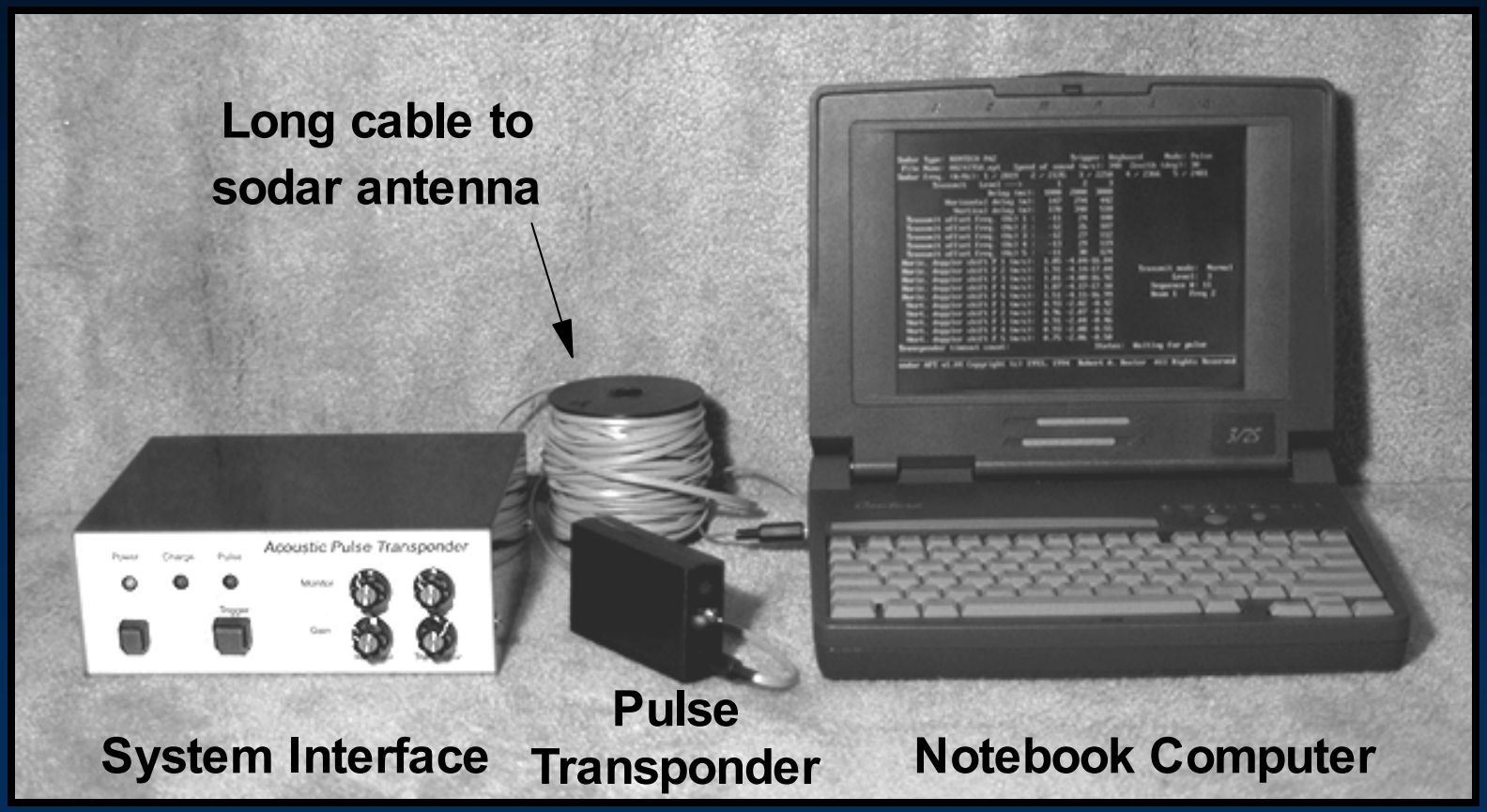
Radar Profiler Wind Audits



Radar Profiler Wind Audits



Sodar Wind Audits
Acoustic Pulse Transponder



Sodar Wind Audits
Acoustic Pulse Transponder

Review of Quality Assurance and Quality Control Procedures

- ⇨ References and guidance
- ⇨ Definitions
- ⇨ QA and QC procedures
- ⇨ Monitoring and quality assurance plans
- ⇨ The role of audits
- ⇨ The audit process